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Introduction

I was invited to take part in this symposium* as President of ALLEA. ALLEA stands for All European Academies, which is the European Federation of National Academies of Sciences and Humanities. The creation of such an international (in this case European) association of Academies was a logical consequence of the internationalization of research and scientific collaboration, and of the increasing tendency to lift the discussion and decision-making on science policy and science implementation to a supra-national level.

Internationalization of science

Science has grown from an individualistic to a collective, collaborative activity. At present science cannot grow in isolation. It presupposes cooperation and contact, exchange of knowledge, expertise and research results. And, of course, these contacts have to cross national borders. The term 'national science' has become almost a *contradictio in terminis*.

The international nature of science and scholarship has always been apparent as was symbolized by the many 'international' scholars in the 15th and 16th century (Erasmus, Keppler, Huygens, Descartes and others), who traveled widely and published for an international public (in Latin, of course), and by the frequent exchange of scholars and scientists between the various European Academies in later centuries. But the global perspective of science has become particularly conspicuous to date with

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the explosive developments of fast and easy electronic communication means. Many research themes have an international character and cannot be studied from a purely national perspective (environment, health and infection diseases, transport, trade, migration, tourism). For a number of mega-programmes single national funding falls short of what is needed and only combined efforts can furnish the necessary means (e.g., European Organization for Nuclear Research (CERN), European Molecular Biology Organization (EMBL) and Southern Observatory (SO)). Moreover, collaboration and collective efforts can strengthen the competitiveness of the higher organizational level (e.g., Europe), a basic argument for Commissioner Busquin to promote the 'European Research Area', with a complementary character and added value vis-à-vis the national research programmes.

But a last and in connection with the theme of this symposium certainly not the least argument is that of international solidarity. International scientific collaboration should also be defended on the grounds of a moral obligation of the Western and economically more advanced countries to support and strengthen R&D capabilities in economically less developed countries. The stronger countries have a world-wide responsibility to assist the countries that are in less favourable conditions and with relatively weak R&D resources to help them to further enhance their research and development capacities. This may often take the form of assistance (aid and support) instead of collaboration (mutual benefit), but in the longer run they may become stronger partners. And there is no doubt that in the very long run such aid/collaboration is the best precondition for peaceful coexistence and economic balance in the world, and is thus beneficial for everyone, including the presently stronger (Western) partner.

Academies of Science

Academies are full and active partners in this international scientific collaborative orb. Also, for the role and contribution of Academies, the rule holds that the whole is more than the sum of the parts: a European association, such as ALLEA, intends to be more than the sum of national Academies in Europe.

The idea of a transnational association of Academies is not new. In 1787 Johann Gottfried Herder stood up for a united German Academy that transcended the local Academies of those times. Later German Academies joined their research efforts in a cartel, since the requirements of an important research programme ('Enzyklopädie der mathematischen Wissenschaften', and 'Thesaurus linguae latinae') exceeded the available resources of any single Academy. In the first 'International Association of Academies' in 1899 many European Academies united: the German Academies of Berlin, Göttingen, Leipzig and München, as well as the Academies from London, Paris (Académie des Sciences), St. Petersburg, Rome and Vienna. One non-European Academy joined, the American National Academy of Sciences (NAS). One year later the Academies of Amsterdam, Brussels, Budapest, Oslo, Copenhagen, Madrid, Stockholm and Paris (the two other Academies within the 'Institut') joined. From this agglomerate and by a politically complicated roundabout way the two most significant international scientific organizations emerged: the 'Union Académique International'

(UAI) for the humanities, and the 'International Council of Science' (ICSU) for the natural sciences.

In Europe new opportunities for co-operation arose in the 1990s, due to the end of the Cold War and the increasing significance of the European Union in the area of science and higher education. Initiated by the Académie des Sciences, the Royal Society, the Royal Swedish Academy and the Royal Netherlands Academy, ALLEA was officially constituted in 1994. ALLEA's members are the national Academies of sciences and humanities. It now has members from all over Europe, from Iceland to the Georgian Republic, from within the European Union and beyond. ALLEA exchanges information and experience among Academies. In ALLEA the national Academies collaborate to serve the scientific community, European political organizations and the general public. Committees and working groups focus on science and ethics, intellectual property rights, privacy in the information society, research strategies in smaller countries and other issues related to science and scholarship in Europe.

In spite of differences in scope and actual realization, Academies share a number of common roles and functions; more specifically: (1) communication (exchange of scientific views and information, meeting and discussion forum), (2) research promotion (originally their primary task, and after having become 'societies of scholars' indirectly still a central responsibility) and (3) the advisory role. It is particularly in the context of this third role that Academies should be concerned with fair-play practices and societal and ethical aspects of science.

The advisory role of Academies

Although the advisory function was not always explicated in academy bylaws many Academies have considered it as their responsibility to convey judgements on the basis of their scientific insights to governments, institutions or the public at large. Also monarchs have acknowledged the usefulness of science for the promotion of trade and commerce, and prestigious Academies like the Royal Society of London and the Académie des Sciences have carried out a good deal of applied research. Leibniz was very disturbed by the fact that Leopoldina restricted itself to pure and fundamental research, and the Brandenburger Sozietät, which he founded in 1700, explicitly included the application of science for the benefit of the state in its objectives.

Later the Academies developed a more explicit advisory role, often in an informal way, but sometimes also formally prescribed by law or regulations. This is possibly the most challenging, but at the same time most controversial role of an Academy. As far as the nature of the advice is concerned we would like to separate out four categories:

1. Advice based upon quality assessments. One may think of advice on continuation, termination or adaptation of certain lines of research, programmes or projects, or of the appraisal of individuals or research groups for the endowment of scholarships or prizes. Also, in recent years, the growing tradition of calling in assistance of visiting committees for the evaluation of departments, faculties or whole institutes Academies can play an important role. Furthermore, mentioning should be made of

research foresight advice, which are concerned with trends and developments in various scientific disciplines, both at the national and international level, which could be used by the government or other relevant institutions for the development of a science policy for the future.

2. Advice regarding science policy, such as the desired balance between pure and applied science, between natural sciences and humanities, and between scientific research and science education. Also advice regarding the content of certain institutionalized forms of organization or financing of scientific research in the country, or advice on curricula of graduate research schools and career opportunities of young scientists fall within this category. Finally this category includes advice on the prioritizing of research areas for funding within the realm of the national strategic research policy.

3. Advice on political decisions, based on scientific research. Some of this advice has a medium or longer term perspective (global change, energy, system of medical care, TV and violence, peace and détente, world population). Other advice has a more immediate or acute character (BSE, mouth and foot disease, radiation of mobile phones, earth-quakes). For some of this advice abundant and solid knowledge is available and needs only 'translation'. In other areas, only incomplete, probabilistic and uncertain knowledge is available, which must lead to a different type of advice (more constrained or more in terms of expected risks and probabilities) or no advice at all, depending on the nature of the issue and the chances and effects of both positive and negative errors.

4. Advice on ethical and societal questions related to or generated by scientific research. Since this specific aspect of the Academies' advisory role precisely concerns the theme of this symposium, we will give some attention to the relationship between science and ethics in the next section.

Ethical and societal issues

With respect to the ethical and societal questions of concern to Academies of sciences and humanities we can make a first distinction between internal and external problems.

Internal ethical problems in science all have to do with (im)proper behaviour of scientists. It is only recently that the academic world has developed concerned interest and has taken a more formal stand in this matter.[1,2] Also ALLEA[3,4] and the European Science Foundation (ESF)[5] have asked that attention be given to the importance of proper ethical conduct and best practice of scientists. We can distinguish the following sub-categories of improper scientific behaviour:

- Unethical behaviour, including fraud (fabrication and falsification of data), deceit (deliberate use of improper analytical or sampling techniques, inaccurate or selective rendition of a colleague's results, etc.) and infringement of intellectual property rights (plagiarism, pinching of a colleague's ideas or discoveries).

- Improper or imprudent behaviour vis-à-vis subjects, including not taking full account of the requirement of informed consent, insufficient observation of the need for anonymity or protection of privacy, open or hidden discrimination, and negligence of the duty to exercise the greatest care in animal research.
- Careless behaviour with respect to the general public and the media, such as too optimistic or unjustified popular reports and interviews, negligence in cases of misquotation by the press, taking no action in cases of wrong or biased interpretation by colleagues or in popular media.
- Disregarding 'good practice' rules, such as justified authorship (only in case of a contribution to the publication), proper sequence of authors (according to significance of contribution, and, if not, alphabetical order, etc.), proper citation, correct dealing with secrecy or delay of publication in the interest of the 'sponsor', avoiding conflicts of interests (e.g. in an evaluative or editorial role).

Science can no longer be seen as an isolated, value-free process. It is embedded in the context of values, interests and political objectives, and as such subject to ethical and societal norms. If we refer to *external* ethical problems that a scientist may encounter, we have in mind this broader political-societal context of the scientific pursuit. One may think of for instance:

- Justification for the choice of the subject of research: is it worth knowing what we pursue? This question is important not only for the researcher personally, but also, since often contract or taxpayer's money is involved, for the sponsor or the public in general.
- Is the research sufficiently independent from 'interested' parties, be it administrative heads, governments, or sponsors? Research results should be absolutely uncontaminated and free from external influence or pressure. This requirement is especially important in sponsored or contract research. Of course, contract research can be independent, unbiased and in perfect agreement with the scientific rules, but it cannot be denied (and there is unfortunately ample evidence) that it may suffer from the overriding temptation to avoid the hand that feeds you.
- Responsibility for what is being done with the research results and by whom. Research results can be used for better or for worse and it is unfortunate that there are many cases in which they are being used irresponsibly. Of course, this misuse does not have to be carried out by the scientist who did the research; it could be politicians, legislators, businessmen, army generals and many others. It would also be inappropriate to refrain from doing research in case it might possibly be abused. That would almost certainly mean the end of all research, because nearly all research results are in principle open to wilful abuse. The question is however to what extent the scientist remains responsible for what is being done with his or her research. Fortunately there is a growing awareness that this responsibility does not stop at the door of the laboratory or research institute.

- Ethical problems generated by the research itself, for example research on stem cells and embryos, research on new and potentially dangerous viruses, research on nuclear fission and fusion with unknown outcomes, research on xenotransplantation, and others. The point here is that the progression of the purely scientific and technical developments may go faster than the reflection on their ethical and moral implications. An interesting question here is where to call for 'no go' or 'slow go' decisions because of these ethical arrears.

As far as the advisory role is concerned, and in particular with regard to the ethical and societal questions, we touch upon an interesting and important issue, namely the supposed primacy of scientific objectives for an Academy. Is not veracity the main touchstone of its activities?

In our view that is true, but it would be a major mistake to derive from this presupposition that scientists, and Academies of science, do not carry moral and societal responsibility. True, scientific practice is inconceivable without the freedom to think, to speak, to carry out and to communicate about research. If science is unable to retain its independent and impartial nature, it will sooner or later become irrelevant and useless. But at the same time there is the – in recent years increasing – need for public accountability. Scientists nowadays are confronted with a variety of ethical, social and political questions which cannot be pushed aside with the argument that they are normative and not scientific. The challenge for scientists and Academies of science in the future is therefore not to make a choice, but to find a balance between freedom and responsibility.

Are Academies equipped for such an advisory role? The following elements make out a good case for an affirmative answer. First, there is the attainability of abundant scientific knowledge and experience within their walls. Second, Academy members are (should be) 'disinterested' in the proper sense of the word: in an ideal case no political, economic, regional or professional interest group can nourish the hope of being especially favoured by an Academy's advice. Third, these members have a firm scientific orientation, and emphasize the free and uncontaminated nature of science. They are independent and there is little danger that they would turn into another political pressure group.

However, whether Academies will also become a major advisor in ethical, social, and legal matters, as described above under 3 and 4, depends on the willingness of the Academies to take the moral and societal accountability of science seriously – which, in turn, depends on the willingness of their members to accept this responsibility – and on the public's willingness to assent to such a role for the Academy. For the latter condition it is important that (1) an academy should truly represent the world of (top) science, including the voices of the younger, and the female scientists, and (2) also the expertise outside an Academy should be mobilized, for instance through its participation in advisory committees and working groups.

A final word

Finally I would like to submit some ideas in the light of the events on the 11th of September. The conclusion that science is truly international leads to the sequitur that also the choice of the optimal balance between freedom and responsibility should be dealt with in a global context. And what happened on September 11 has added a new dimension to this freedom and responsibility. In this connection I would like to suggest:

- Academies should offer their assistance to fight and prevent terrorism. This could lead to reallocation of time, energy and financial resources for the study of the nature and the determinants and consequences of this phenomenon.
- Academies should also take part in the public debate by offering their insights and knowledge about chances and risks of terrorist weaponry, including nuclear, chemical and biological instruments, aiming at helping governmental decisions and possibly reducing public anxiety.
- Targeting scientists from Islamic countries and the exclusion of certain Islamic countries from knowledge is both ineffective and unacceptable. No prohibition for scientists from these countries to attend scientific gatherings should be allowed, in accordance with the ICSU doctrine on universality of science requiring free speech, contacts and travel for all scientists.
- More intensive collaboration with scientists from Islamic countries could help to further insights in possible philosophical and cultural differences between 'Western' and Islamic scientific approaches. Such collaboration could contribute to a better understanding and to building bridges between two cultures.

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